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Author(s): Piroska Csúri

Proceedings of the Twenty-First Annual Meeting of the Berkeley Linguistics Society: General Session and Parasession on Historical Issues in Sociolinguistics/Social Issues in Historical Linguistics (1995), pp. 60-71

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The Annual Proceedings of the Berkeley Linguistics Society is published online via [eLanguage](http://eLanguage.org), the Linguistic Society of America's digital publishing platform.

ONE-ANAPHORA AND RESIDUAL DRS'S

Piroska Csúri
Brandeis University

0. **INTRODUCTION.** Recent linguistic approaches to discourse (Webber:1979, Kamp:1981, Heim:1982) set out to unravel the behavior of anaphoric elements in a text. All of these frameworks attack the problem of anaphora by introducing discourse markers or discourse referents (following Karttunen:1976) as mediators between linguistic entities (NP's) and their model theoretical interpretation. Accordingly, all of the above frameworks concentrate on how to representation pronominal anaphoric relations, as in:

- (1) *Ed* would like to resolve the situation one way or another
before *he* leaves office... WSJ

In this paper I argue that, to give an adequate description of anaphora, one must consider another (equally common and important) type of anaphoric expression as well:

- (2) The company opened its *procurement office* here last fall
(another *one*, its first, is in San Francisco)... WSJ

I show that the anaphoric relations between the italicized elements in (1) and (2) exemplify two, markedly different types of anaphora.

Intuitively, the difference between the two anaphoric types consists in whether the anaphoric element in question reactivates (a) the discourse referent/token (as with pronominal anaphora in ex.1) introduced by the nominal expression construed as the antecedent or (b) the descriptive content/type/sense introduced by that nominal expression (as with *one*-anaphora in ex.2). I will call these two types of anaphoric relations Referential and Descriptive anaphora, respectively.

To empirically set the two types apart, I will use the test of modal subordination (see Roberts:1986 following Karttunen:1976). Given the distinction between the two types of anaphora, I propose a substantial modification of standard Discourse Representation Theory (see Kamp & Reyle:1993) to accommodate *one*-anaphora into that framework. For reasons that become clearer later, I will call the modified DRT structure a Residual Discourse Representation Structure, or RDRS. The overall moral of the paper, however, states that (no matter what framework we consider) all anaphoric expressions cannot be treated uniformly, as the different behavior of pronominal anaphora and *one*-anaphora demonstrates.

1. **REACTIVATING A DISCOURSE REFERENT v. REACTIVATING A DESCRIPTION.** Let us then turn to the distinction that underlies the difference between the two types of anaphora.

1.1. **THE AMBIGUITY.** Consider the following examples:

- (3) Bill brought *a ham sandwich with pickles* for lunch today.
 a. ...It was *the same sandwich* he brought yesterday. /same token/
 b. ...Joe brought *the same sandwich* as well. /same kind/
- (4) Bill drives *the Honda over there*.
 a. ...His wife drives *another car*, which is also a Honda. /different token/
 b. ...His wife doesn't like Hondas, and drives *another car*. /different kind/

The sentences in (3)-(4) exemplify a systematic ambiguity. Namely, they show that a single linguistic expression (with the exact same phrase as antecedent) can appear with two distinct readings, depending on its context. In the (a) sentences the italicized phrase acts as anaphoric on the **token** introduced by its construed antecedent, while in the (b) sentences it is anaphoric on the **kind** introduced by that antecedent. For example, given the continuation in (3a), Bill is assumed to have brought the same **token** sandwich for lunch today as he did yesterday, let's say because he did not have time to eat it yesterday. With the continuation in (3b), however, pragmatic factors tell us that Joe's and Bill's sandwiches are different tokens of the same kind of sandwich. A similar ambiguity holds for the two continuations in (4), whether we are talking about a different token or just a different kind from the car that Bill drives.¹

The two readings in examples (3)-(4) therefore arise depending on whether the antecedent is taken to be the discourse referent or simply the description introduced by the antecedent phrase of the anaphoric expression. If it is the discourse referent (token) introduced by the antecedent phrase that acts as the antecedent, I call the anaphoric relation **REFERENTIAL ANAPHORA**, while if the description (type or kind) acts as the antecedent, I call the anaphoric relation **DESCRIPTIVE ANAPHORA**. The most important point here is that the distinction between the two types of anaphora (that is, Referential v. Descriptive) cannot always be attributed to a given linguistic expression.² Although *one*-anaphora will always involve anaphoricity on kind, expressions such as *the same sandwich* or *another car* can act either as Referentially anaphoric, or as Descriptively anaphoric.

1.2. **COMPARISON WITH OTHER ANAPHORIC DISTINCTIONS.** The Referential v. Descriptive distinction made in this paper closely resembles a couple of

earlier proposals. In particular, it is parallel to the distinction between **identity-of-reference** v. **identity-of-sense** anaphora proposed by Grinder & Postal (1971), as well as the distinction between **concrete entity** v. **concept** anaphora advocated by Asher (1993). The most well-known distinction among different anaphoric types, however, is the distinction between **deep** and **surface** anaphora put forth by Hankamer & Sag (1976) (which was later recast in Sag & Hankamer:1984 as a distinction between model interpretive anaphora and ellipsis). I only consider the last of these three distinctions in any detail here.

Sag & Hankamer (1984) summarize the following three tests to distinguish deep anaphora from surface anaphora:

(a) only deep anaphora can be used deictically, can be 'pragmatically controlled';

(b) only surface anaphora requires parallelism in syntactic form between anaphor and antecedent;

(c) only surface anaphora exhibit the 'missing antecedent' phenomenon. In S&H's system pronominal anaphora and sentential *it* are instances of deep anaphora, while VP-ellipsis, gapping, sluicing, and stripping instantiate the ellipsis type of anaphora.

Assuming the tests above, *one*-anaphora exhibits certain properties of both types of anaphora. First of all, *one* can be used deictically (pragmatically controlled), as the following example shows, which is assumed to be characteristic of model interpretive anaphora:

- (5) [...walking up to a balloon vendor...]
Could I have a purple *one*? *one* = balloon

On the other hand, *one*-anaphora seems to require some sort of syntactic parallelism (or semantic contrast) between the antecedent and the anaphor, a property which supposedly characterizes ellipsis type anaphora:

- (6) I like the blue *balloon* more than the yellow *one*.
(7) ?? Our *dog* mated with a black *one*.

It has been noted that so-called paycheck pronouns require syntactic parallelism, and it is easy to see as well that *one*-anaphora patterns with VP-anaphora in that they both involve reactivation of descriptive material. Given these facts and arguments (showing *one*-anaphora as well as pronominal anaphora as sharing certain properties of both deep and surface anaphora), I take that the Referential v. Descriptive anaphoric distinction is orthogonal to the deep v. surface anaphoric distinction.

2. *ONE-ANAPHORA AND MODAL SUBORDINATION.* By now we have established the intuitive distinction in the nature of the anaphoric link for the cases of *one-anaphora* and pronominal anaphora. It is therefore time that we turned to some formal differences between the two anaphoric types. The crucial test I present here involves modal subordination phenomena.³

2.1. *WHAT IS MODAL SUBORDINATION?* Data pointing to effects of modal subordination was first introduced in Karttunen (1976) under the terminology of short term discourse referents, which was later taken up and generalized by Roberts (1986) within the DRT framework under the terminology of *MODAL SUBORDINATION*. From the point of view of anaphora, modal subordination simply stands for the effect that modal contexts exercise on the licitness of anaphoric links. In particular, if a (non-specific) indefinite antecedent is introduced in a non-factual context (e.g., within the scope of a modal operator, or negation), it is inaccessible for a subsequent pronominal anaphor, unless the anaphor appears in a sentence that is a modal continuation of (i.e., is modally subordinated to) the sentence in which the antecedent appeared. To be more precise, consider the examples in (8) and (9):

- (8) a. If Joe bought *a book*, he'll be home reading it by now.
b. *It*'ll be a murder mystery.
- (9) a. If Joe bought *a book*, he'll be home reading it by now.
b. *#It's* a murder mystery.

In (8) (which is Roberts' ex.4) *a book* is introduced within the scope of a conditional operator. (8b) is interpreted as continuing the modal context induced by *if*, thus antecedent clause of (8a) is part of the common ground (or presupposed material) for (8b).

On the other hand, when the second sentence introduces factive mood, as in (9) (which is Roberts' ex.3), the picture looks different. Even though the conditional itself (9a) is presupposed (part of the common ground), its antecedent clause is not presupposed. Therefore the existence of *a book* is not presupposed (not part of the common ground for ex.9b), and pronominal anaphoric reference to it is illicit.

Similar facts hold for negation: If a (non-specific) indefinite (such as *a power plant* in ex.10) is introduced in the scope of negation, it is unavailable as an antecedent for a pronominal anaphor from a subsequent declarative sentence as well, because the existence of a power plant is not presupposed:

- (10) Mike has never seen *a power plant*. He is visiting *#it* tomorrow.

To sum up, examples (8)-(10) therefore show that pronominal anaphora exhibits modal subordination effects.

2.2. LACK OF MODAL SUBORDINATION EFFECTS. As it turns out, *one*-anaphora does not show the same modal subordination effects as pronominal anaphora does. Let us see the evidence that demonstrates this point. Consider (11) and (12), which parallel (9) and (10), respectively:

(11) If Joe really bought a *car* today, he is driving to Yosemite now.
He went to the dealer to buy *one* this morning.

(12) Mike has never seen a *power plant*. He is visiting *one* tomorrow.

In these examples the antecedent of *one* is introduced either within the scope of a conditional operator or within the scope of negation, while the sentence containing the anaphor *one* is not modally subordinated to the first sentence. Still, the anaphoric link between the intended antecedent and anaphor is licit. In other words, *one*-anaphora does not show modal subordination effects.⁴

3. DRT REPRESENTATION OF PRONOMINAL ANAPHORA. This takes us to the main question of the paper, namely how anaphoric relations should be represented, given the different behavior of pronominal anaphora and *one*-anaphora. Here I will take standard Discourse Representation Theory as my starting point, as presented in Kamp & Reyle (1993) and Roberts (1986). In Section 4. I offer a modification of their theory to accommodate *one*-anaphora. But first we have to review quickly how pronominal anaphora is generally represented in DRT.

The main innovation of Karttunen (1976), Webber (1979), and other discourse oriented approaches such as Kamp's (1981) Discourse Representation Theory (DRT) and Heim's (1982) File Change Semantics (FCS) consists in their treatment of nominal expressions. Nominals (such as indefinites, pronouns, etc.) are no longer taken to refer directly to real world entities or entities in a model; instead, they are assumed to introduce variables into the representation, so-called DISCOURSE REFERENTS. These discourse referents can be interpreted in mapping them into a model of the actual world, as it is done in DRT or FCS. Under such a view of discourse anaphoricity is expressed as a condition expressing the identity of the values of two variables. That is, for a mini-discourse such as (13) (after Heim:1982), we get the DRT representation below:

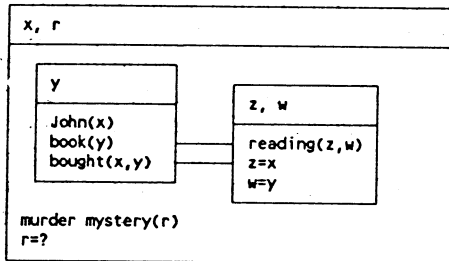
- (13) Otto owns *a sheep*. Harry vaccinates *it*.

x, y, z
$\text{owns}(x, y)$ $\text{Otto}(x)$ $\text{sheep}(y)$ $\text{vaccinate}(z, v)$ $\text{Harry}(z)$ $z=y$

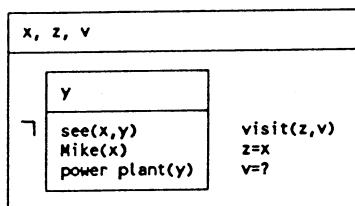
In the DRT representation discourse referents are introduced in the 'universe' of the Discourse Representation Structure (DRS), at the top of the representation. At the same time, predicates attributed to the discourse referents are listed in the body of the DRS as conditions. The last condition of the DRS is taken to express that the pronoun *it* refers back to the sheep Otto owns, by explicitly stating the identity of the two variables y and z , which were introduced as discourse referents for *a sheep* and *it*.⁵

The other property of pronominal anaphora relevant for us is that of exhibiting modal subordination effects, as discussed in Section 2.1. In DRT, following Roberts (1986), modal contexts and negation are represented by subDRS's, which are embedded into the main DRS representing the discourse. SubDRS's come with their own universe, and the relevant operator can be affixed to the subDRS as presented here (modal subordination is expressed with the double line between the subDRS's):

- (14) If Joe bought *a book*, he'll be home reading it by now. #*It's a murder mystery*.



- (15) Mike has never seen a *power plant*. He is visiting #it tomorrow. [=10]



As shown, indefinites and pronouns introduce discourse referents in the universe of their own subDRS (in which they are introduced), while proper names introduce a discourse referent in the universe of the main DRS.

Given the above representations let us look at the intended anaphoric links. In (14) (which is Roberts' ex.9) the anaphoric reference $w=y$ is licit, since the subDRS where w is introduced is subordinate to the subDRS where y is introduced. However, the universe of the antecedent clause is not accessible to r , since r was introduced in the main DRS, which is not subordinate to the subDRS expressing the antecedent clause. This is why the intended reference $r=y$ fails.

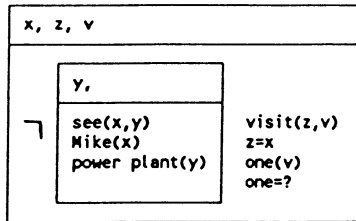
For (15), the intended anaphoric reference $v=y$ is illicit because the discourse referent y is introduced into the universe of the embedded DRS, and therefore it is not accessible from the main DRS (where v is introduced), which is not subordinate to the subDRS in (15).

4. DRT AND ONE-ANAPHORA. Accepting the above as the proper treatment of pronominal anaphora, let us turn to the question how *one*-anaphora should be represented in the DRT framework.

4.1. DESCRIPTIONS AS PROPERTY VARIABLES? First of all, recall the preliminary observation of Section 1.1. stating that *one*-anaphora reactivates a description, as opposed to pronominal anaphora, which reactivates an (individual) discourse referent. How can we express this intuitive difference in the formal representation?

We certainly cannot assume that *one* takes the condition *power plant*(x) as its antecedent:⁶

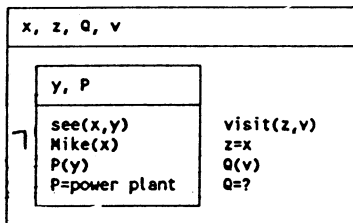
- (16) Mike has never seen a *power plant*. He is visiting *one* tomorrow. [=12]



The condition *power plant*(x) is not a predicate, therefore it cannot be applied to v as a function. Adding the condition $v=y$ would not help either, since it would lead to an incorrect interpretation of the discourse.

Now suppose that *one*-anaphora also involves an anaphoric link between some kind of discourse referents. These discourse referents, obviously, could not be of the type 'individual', rather they would need to be property variables introduced alongside individual variables.⁷ Then the representation for (12) in DRT terminology would look approximately as below:

- (17) Mike has never seen a *power plant*. He is visiting *one* tomorrow. [=12]



Under this proposal there are two discourse referents associated with a *power plant*: the individual variable y , and the property variable P . Supposedly, the property variable would be introduced within the universe of the (sub)DRS alongside discourse referents for individuals. The anaphoric *one* itself would stand for a property variable as well, and the anaphoric link would be expressed as a condition on the identity of the values of two property variables, just like in the case of pronominal anaphora and individual discourse referents.

Given the representation in (17), the problem is already obvious. In the second sentence *one* licitly refers back to the description *power plant*. However, this description was introduced within the scope of negation, and thus the property variable was introduced in the universe of the embedded subDRS. Therefore, according to the general constraints on the accessibility

of antecedents, the anaphor *one* could not licitly access this (property) discourse referent as its antecedent, the intended $Q=P$ anaphoric reference is predicted to fail, even though in reality it is perfectly acceptable. The question remains, how should we represent *one*-anaphora then?

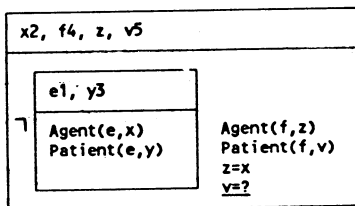
4.2. ONE-ANAPHORA AND RESIDUAL DRS'S: THE PROPOSAL. To remedy the problems mentioned in the previous section, I suggest the following modification of standard DRT. Since descriptions are available as antecedents across all modal contexts, there is no reason to include them within the modally structured DRS's. Instead, let us assume that descriptions are introduced on a representational level parallel to the level containing the discourse referents in the DRS's. Let us call these two levels Descriptive Tier (DT) and Referential Tier (RT), respectively. The specific proposal I make here is only partially motivated by the behavior of *one*-anaphora, hence the proposed representation might seem somewhat ad hoc.⁸ This representation nevertheless proves useful in explaining various phenomena such as quantification, distributivity, and specificity. Therefore from here on, to illustrate the full force of the proposal, I will include eventuality variables in the upcoming representations. Disregarding them in the paper so far, however, did not affect any of the arguments made.

Let us now see the actual proposed representation:

- (18) Mike has never seen a *power plant*.
 a. He is visiting *#it* tomorrow. [=10=15]
 b. He is visiting *one* tomorrow. [=12]

DT -- List of functions
 { $\lambda e(\text{seeing } e)$ 1}; { $\lambda x(\text{called-Mike } x)$ 2}; { $\lambda x(\text{power plant } x)$ 3}; { $\lambda e(\text{visiting } e)$ 4};
{ one 5}={ $\lambda x(\text{power plant } x)$ }

RT -- Residual DRS



e, f - eventuality variables
 x, y, z, v - individual variables

The RT contains a kind of DRS that looks much like a standard DRS in that it contains discourse referents in a modally structured representation of the discourse. On the other hand, it looks very different from standard DRS's in terms of what it contains as conditions in the body of the DRS. Instead of the usual predicates, it contains a neo-Davidsonian representation which associates individual variables with the eventuality variable, by designating them as

Agent, Patient, etc. Since this DRS is stripped of the conditions that are normally represented in it, I will call this a *RESIDUAL DRS*, or *RDRS* for short. In interpreting the representation, elements of the RT will carry existential claim (even if within the scope of a modal operator) in the same fashion as in standard DRT. This is the representational level which is responsible for quantification, distributivity, and specificity effects. And most importantly for us, (Referential) pronominal anaphora takes place on this level as well; again, observing the same conditions and constraints as in standard DRT.

The DT of the representation then contains a list of λ -extracted versions of the predicates which are normally listed as conditions in the body of a standard DRS. Elements on this tier therefore do not express any existential claim, nor are they arranged in a modally structured representation. Given that the RDRS now includes eventuality variables as well, the DT will also include eventuality predicates, λ -extracted of course, which specify the type of eventualities mentioned in the given discourse. This level of the representation will be the site of *one*-anaphora (and Descriptive anaphora in general), where the only condition on accessibility is ordering in the list.⁹

The two levels of the representation are linked via a co-indexing mechanism. The coindexing is interpreted as function application. That is, coindexing a λ -extracted predicate from the DT and a variable from the RT boils down to ordinary predication after λ -conversion, and the effective interpretation of the representation is equivalent to that of standard DRT. The two representations, however, are not functionally equivalent, since the present proposal offers a unique organization of the representation which allows for a formal representation of *one*-anaphora, an anaphoric relation that standard DRT cannot handle.¹⁰ Therefore by reorganizing the representation we do not lose anything, but gain an explanation for an extended class of anaphoric phenomena.

Finally let us see how an RDRS representation derives the desired results, and solves the problems that arose in connection with *one*-anaphora. In the representation above I combined the two representations for (10) and (12), where the underlined material indicates the two intended anaphoric relations for (18a) and (18b).

The discourse referent v still cannot access y as its antecedent, since accessibility conditions for discourse referents within an RDRS are the same as for a standard DRS. Thus we derive modal subordination effects for pronominal anaphora. On the other hand, anaphors on the DT behave differently. Since the DT simply contains a list of functions without intervening modal structure, *one* is free to access $\lambda x(\text{power plant } x)$ as its antecedent. That is, with the representation in (18) we derive the fact that *one*-anaphora is exempt from modal subordination effects, while maintaining an account of the modal subordination effects for pronominal anaphora.

5. **CONCLUSION.** In this paper I presented evidence from the behavior of *one*-anaphora to show two points. First, given the different behavior of *one*-anaphora and pronominal anaphora we are forced to conclude that no uniform treatment of anaphoric elements is possible, irrespective of what framework we consider. Second, I showed how standard DRT can be modified to extend its scope to *one*-anaphora, without losing any of the results for the treatment of pronominal anaphora.

*I want to thank Donka Farkas, Ray Jackendoff, Christopher Kennedy, Ewan Klein, Jason Merchant, Mariano Plotkin, and the audience at BLS for comments on different versions of this paper. For all remaining mistakes and problems I take sole responsibility.

¹ For an indefinite NP to be anaphoric on an antecedent the anaphoric relation has to be a contra-indexing relation, as opposed to a co-indexing one. For more arguments that contra-indexing relations indeed show the characteristics of anaphoric relations see Csúri (1995).

² If the anaphoric expression alone specified whether the anaphoric relation was Referential or Descriptive, the resolution of anaphoric expressions would be one degree less complicated.

³ In addition to modal subordination, however, there are other tests that distinguish Referential v. Descriptive anaphora, involving the presence or lack of E-type and bound variable readings. For a discussion of these tests see Csúri (in prep.).

⁴ Here I argue that the modal structure of the discourse does not constrain *one*-anaphora in any way. For a suggestion that modality might pose certain restrictions on *one* see Merchant (1994).

⁵ Note that such a representation produces the E-type reading of a pronoun discussed by Evans (1980) and others.

⁶ This argument is a simpler version of Klein's (1987) argument as to why VP-ellipsis cannot simply be represented with a property variable.

⁷ A proposal along similar lines has been made by Hardt (1993). Using Groenendijk and Stokhof's (1991) Dynamic Predicate Logic framework he proposed that VP-ellipsis be represented as anaphora on a property variable.

⁸ For details on additional motivation for, and further advantages of, the RDRS representation please stay tuned for Csúri (in prep.).

⁹ In Heim's File Change Semantics the DT would be equivalent to a single file card which lists all the functions that have been mentioned in the discourse. That way expressions anaphoric on functions would have unlimited access to antecedents.

¹⁰ Klein (1987) offers a DRT analysis of VP-ellipsis, which Asher (1993) extends to other types of concept anaphora. For some problems with these analyses see Csúri (1995) and Csúri (in prep.).

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